Let's Learn Linux: Introduction

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#linux #cli #terminal #ubuntu

Let's first understand what is Operating System(O.S):

- An **OS is system software** that **manages computer hardware** and **software resources** and provides common services for computer programs.
- In a nutshell, An OS is software that **acts as a middleman** or **a bridge** between c**omputer hardware and the computer user***. It provides a user interface and controls the computer hardware so that software can function.

Types of OS:

1. **Desktop OS**: Windows, macOS, Linux such as Ubuntu
2. **Server OS:** Windows server, Linux distributions like CentOs, Red Hat Enterprise Linux
3. **Mobile OS:** Android, iOS, Windows Mobile
4. **Embedded OS**: used in devices like routers, smart TVs, automobiles, home appliances, etc.
5. **Real-Time OS**: used in critical systems like medical equipment, car ECUs, aerospace, defense, network firewalls, home security systems, etc.

What is Linux:

- It is a free and open-source OS, and it is:
  - Secure
  - Distributed
  - Fast
- Its open-source nature means that a community of developers and users contribute to its development.
- It's similar to Windows and macOS, but it's different in several ways
- Linux is very popular for its **stability**, **security**, and **flexibility**. It can be modified and distributed by anyone, which has led to many different versions, known as "**distributions**" and each distribution is tailored(for a particular purpose) for different users.

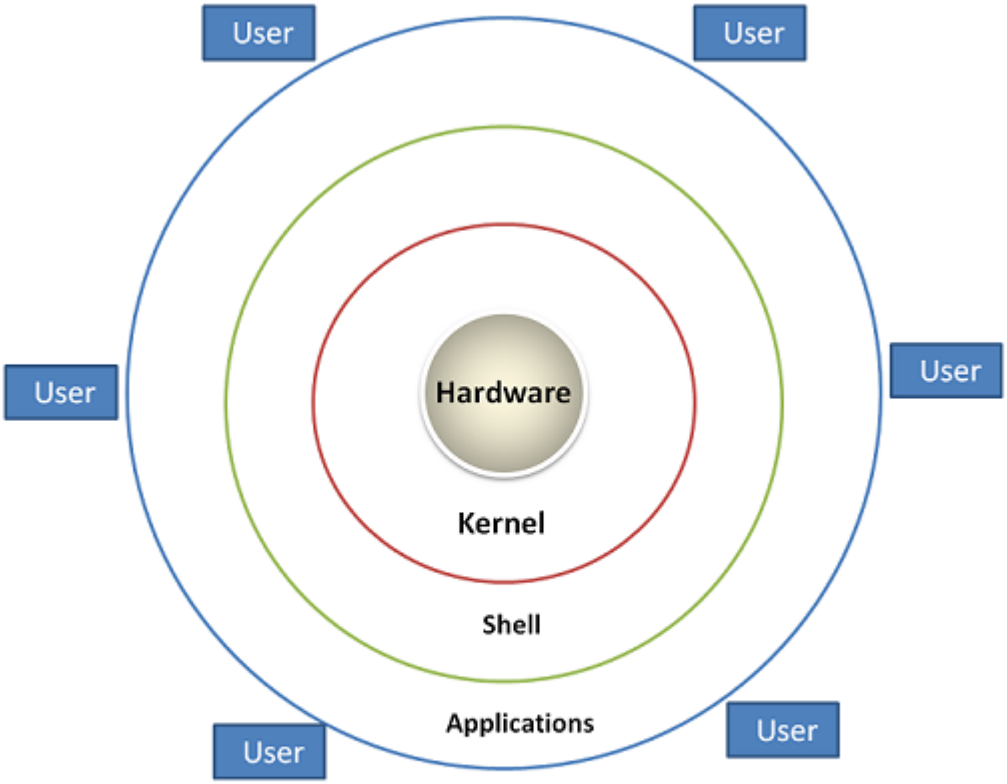
Why learn Linux or its importance:

- Widely used in servers and cloud computing
- corporate world uses Linux as their primary OS
- Free software philosophy
- Strong command line interface
- Faster processing (because of CLI)
- Enhanced security
- Customization because of the open-source nature
- Community support
- Understanding of other OS
- Career opportunities

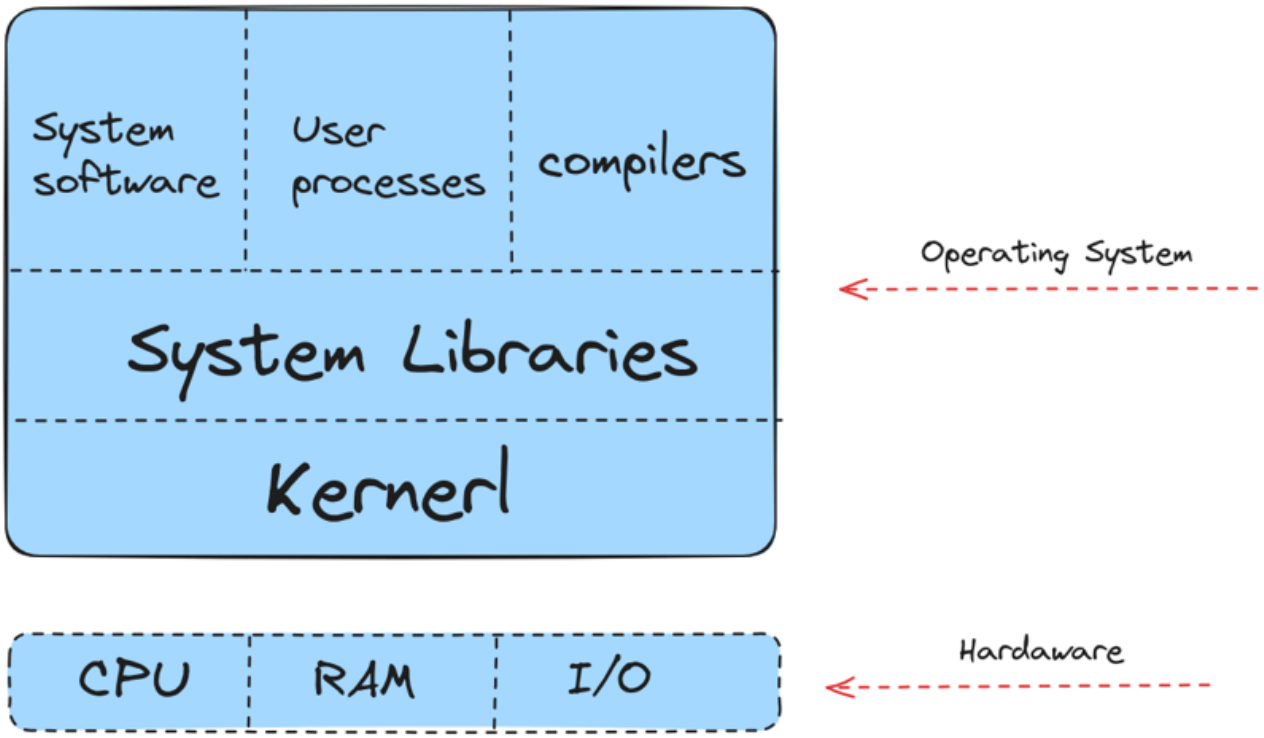
Linus is a kernel-based Operating System:

> **What is the kernel:** The core of the **UNIX** system. **Kernel** is the **heart** of your operating system because it establishes the communication between the hardware and the software.

Below is the Architecture:



Linux System Architecture



Basically, kernel has four primary responsibilities:

- Device managemant
- Memory management
- Process management

- Handling for your **system calls**

History of Linux:

Before Linux:

- **UNIX**: Developed in the 1970s at AT&T Bell Labs by Ken Thompson and Dennis Ritchie - **UNIX is a proprietary operating system**
- **GNU Project**: In 1983, Richard Stallman launched the GNU(GNU's Not UNIX) project - **GNU is a free and open-source software**

  While many tools and utilities were developed under the GNU project, a completely free OS was missing **a kernel.**

Birth of Linux:

- 1991: A 21-year-old Finland student named **Linus Torvalds** started developing a free OS kernel as a hobby project.
- On August 25, 1991, Linus announced his project on the Minix newsgroup.

  > "I'm doing a (free) operating system (just a hobby, won't be big and professional like GNU")

- Version 0.01 was released in September 1991
  - Not Functional
  - Released to the public
- Version 0.02 Later in 1991
  - Functional
  - Combined with the utilities from the GNU project

It formed a completely free operating system.

Growth and Evolution:

- The early 1990s: Linux rapidly evolved through collaboration over the Internet.

  So many distributions came like **Slackware and Debian.**
- 1993: Linux 1.0 was released with **176k lines of code.**
- Late 1990s: Commercial interest in Linux grew.

  Like **Red Hat and SUSE**
- 2000s: Linux saw significant adoption in server markets.
- In 2007, Google released the Android OS for Mobile devices.

Today:

Linux has grown from a hobbyist's project into a powerful force in computing, powering everything from mobile devices, personal computers, and servers to mainframes and supercomputers.

> So simply put, the story of Linux isn't about a computer system. It's about great people from all over the world working together and making this reliable, secure, and open-source operating system.

Important things to remember in Linux:

- Linux has a super-user account called root
  root is the most powerful account that can create, modify, delete accounts, and make changes to system configuration files. It even can delete the entire operating system.
- Linux is a case-sensitive system
  ABC is NOT the same as **abc**
- Avoid using spaces when creating files and directories
- Linux kernel is not an OS. It is a small software within Linux OS that takes commands from users and passes them to system hardware or peripherals.
- Linux is mostly CLI, not GUI
- Linux is very flexible as compared to other operating systems.

Linux Filesystem:

It is a system used by an operating system to manage files. The system controls how data is saved or retrieved.

These are the Linux file system:

- **Ext4**: This is the most widely used file system in Linux and it is known for its high performance, reliability, and scalability.
- **XFS**: This is a high-performance file system that is optimized for large-scale data storage and is commonly used in enterprise and high-performance computing environments.
- **Btrfs**: This is a newer file system that is designed to be flexible, scalable, and easy to manage.

These are the Windows files system:

- **NTFS**: This is a file system commonly used in Microsoft Windows and it is supported by most modern Linux distributions.
- **FAT32**: This is an older file system that is commonly used in older Microsoft Windows systems and is also widely used for removable storage devices such as USB drives and has limitations such as a maximum file size of 4GB.

File System Structure and its Description:

1. **/** (Root Directory): The top-level directory that contains the entire file system hierarchy.
2. **/boot:** Holds files essential for the system's boot process, including the kernel and bootloader configuration.

3. **/bin:** Contains fundamental binary executables (commands) accessible to all users.
4. **/etc:** Stores system-wide configuration files and directories, including application-specific configurations.
5. **/home:** Home directories for individual users.
6. **/lib and /lib64:** Libraries required for the functioning of executables in `/bin` and `/sbin`.
7. **/sbin:** Contains system binaries used for system administration tasks, requiring superuser privileges.
8. **/usr:** Holds user-related programs, libraries, and documentation.
9. **/var:** Contains variable data such as log files, mail, and temporary files.
10. **/tmp:** A directory for temporary files accessible to all users; contents are typically cleared on system reboot.
11. **/dev:** Contains device files representing physical and virtual devices attached to the system.
12. **/proc:** A virtual file system providing information about processes and system resources.
13. **/sys:** A virtual file system exposing kernel parameters and settings.
14. **/mnt:** Traditionally used as a mount point for temporary filesystems or external devices.
15. **/opt:** Used for the installation of additional software packages not part of the default system installation.
16. **/srv:** Intended for data served by the system, such as website content or file-sharing services.
17. **/root:** Home directory for the root user (superuser).
18. **/run:** A temporary filesystem holding runtime information about the system since the last boot.
19. **/lost+found:** Used by the `fsck` utility to store recovered files and fragments during filesystem repair.
20. fsck

    `fsck` is a command-line utility used for checking and repairing file system inconsistencies, and the `/lost+found` directory is used by `fsck` to store recovered files and fragments during the repair process.

What is Root?

There are 3 types of root in the Linux system:

1. **Root account:** root is an account or a username on a Linux machine and it is the most powerful account that has access to all commands and files.
2. **Root as /:** the very first directory in Linux is also referred to as a root directory.
3. **Root home directory:** the root user account also has a directory located in /root which is called root home directory and accessed by /home command.

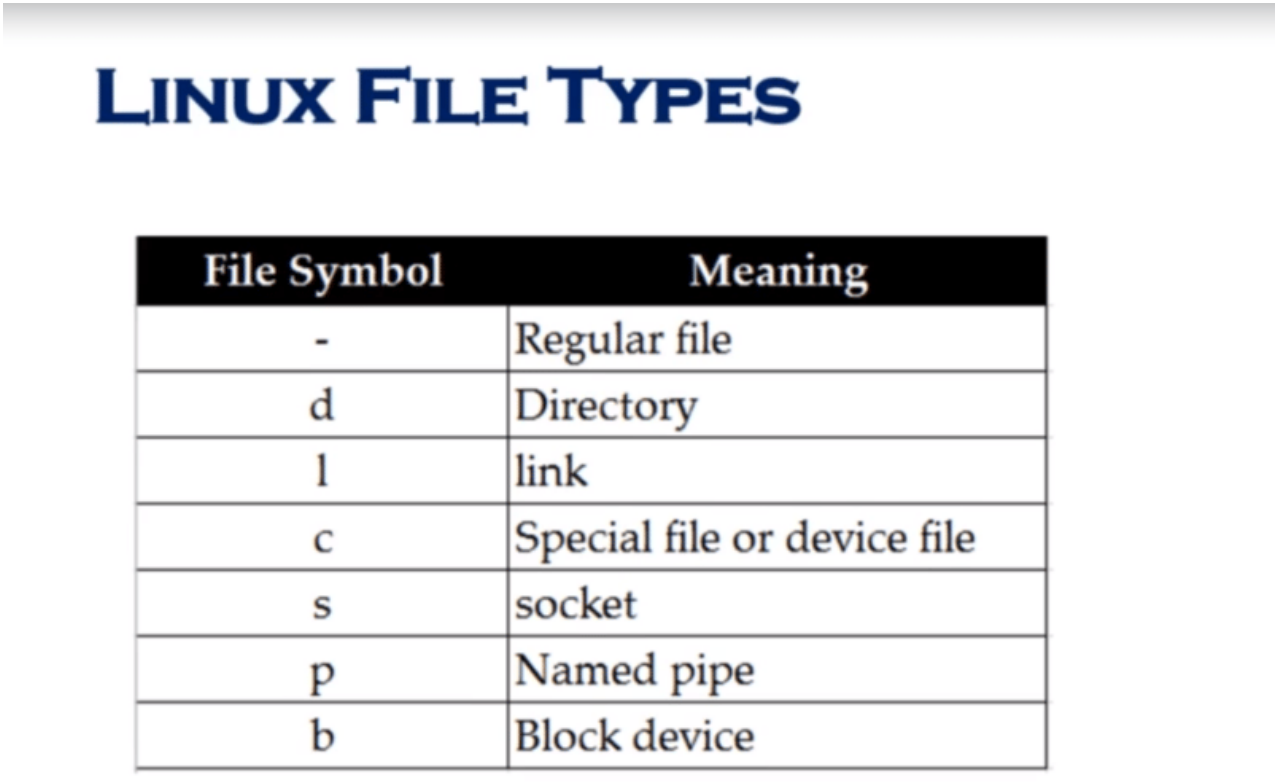
Linux file types:

```
surajkumar00@devops-bro:~$ ls -ltr
total 584264
drwxr-xr-x 2 surajkumar00 surajkumar00      4096 Jan 13 00:16  Videos
drwxr-xr-x 2 surajkumar00 surajkumar00      4096 Jan 13 00:16  Templates
drwxr-xr-x 2 surajkumar00 surajkumar00      4096 Jan 13 00:16  Public
drwxr-xr-x 2 surajkumar00 surajkumar00      4096 Jan 13 00:16  Music
drwx------ 7 surajkumar00 surajkumar00      4096 Jan 14 14:14  snap
-rw-rw-r-- 1 surajkumar00 surajkumar00    864025 Jan 14 14:31 'Unconfirmed 330968.crdo
wnload'
-rw-rw-r-- 1 surajkumar00 surajkumar00 426087280 Jan 14 14:34  docker-desktop-4.26.1-a
md64.deb
-rw-rw-r-- 1 surajkumar00 surajkumar00    162431 Jan 17 17:00  History+of+Unix.pdf
-rw-rw-r-- 1 surajkumar00 surajkumar00 105000828 Jan 17 17:11  google-chrome-stable_cu
rrent_amd64.deb
-rw-rw-r-- 1 surajkumar00 surajkumar00  34832128 Jan 17 17:14  google-chrome-stable_cu
rrent_amd64.deb.1
drwxr-xr-x 4 surajkumar00 surajkumar00      4096 Jan 17 17:19  Pictures
-rw-rw-r-- 1 surajkumar00 surajkumar00     62424 Jan 18 16:52  linux-architecture-imag
e.png
-rw-rw-r-- 1 surajkumar00 surajkumar00     15392 Jan 18 17:03 'Kernel diagram.excalidr
aw'
```

Above you can see the file type starts with:

- d - is a directory
- ' - ' is a file

Below you can see more:



File System Paths:

There are two paths to navigate to a filesystem:

Absolute Path:

An absolute path always begins with a '/'. This indicates that the path starts at the root directory. An example of an absolute path is:

```
cd /var/log/suraj
```

2. **Relative Path:**

- A relative path does not begin with a “/”. It identifies a location relative to your current position. An example of a relative path is:

`cd /var`

`cd log`

`cd suraj`

Find Files and Directories:

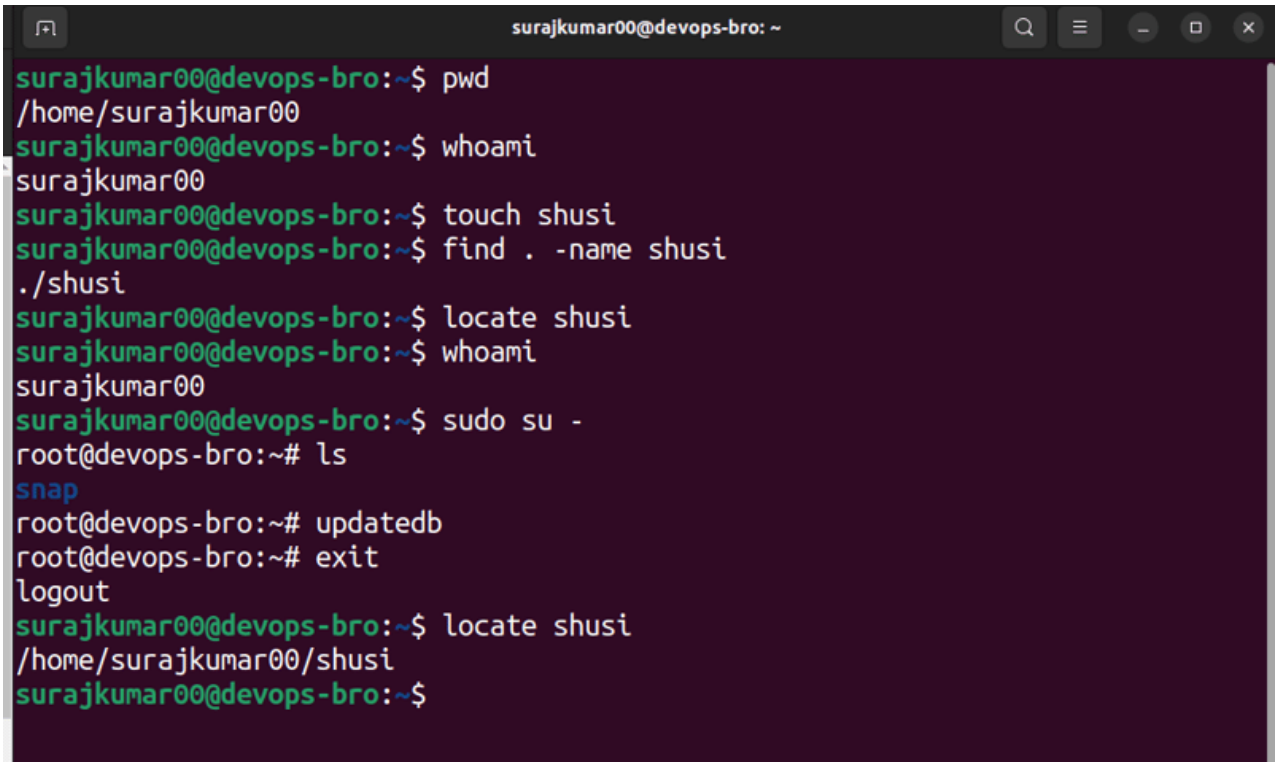
Two main commands are used to find files/directories

- find
- locate

These are the key differences between find and locate

- **locate**, uses a prebuilt database, which should be regularly updated, while **find** iterates over a filesystem to locate files. Thus, locate is much faster than find, but can be inaccurate if the database (can be seen as a **cache**) is not updated.
- to update **locate** database run **updatedb**

Here is how we can do it hands-on:



WildCards:

A wildcard is a character that can be used as a substitute for any of class of characters in a search

- represents zero or more characters
- ? - represents a single character
- [ ] represents a range of character
- do explore other wildcards

Here is how we can do it hands-on: